CASA IMMUNIZATION COVERAGE SURVEY

2003

Jennifer M. Hill, M.P.H.

Kansas Department of Health and Environment
Division of Health
Bureau of Epidemiology and Disease Prevention
Epidemiologic Services
1000 SW Jackson, Suite 210
Topeka, Kansas 66612-1290
Telephone (785) 296-8156
Fax (785) 291-3775

ACRONYMS

4-3-1-3-3	4 doses of DTP, 3 doses of Polio, 1 dose of MMR, 3 doses of Hib, and 3 doses of HepB vaccines
3-2-2-2	3 doses of DTP, 2 doses of Polio, 2 doses of Hib, and 2 doses of HepB vaccine
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
CASA	Clinic Assessment Software Application
CDC	Centers for Disease Control and Prevention
CII	National Childhood Immunization Initiative
DTP3	3 doses of diphtheria, tetanus, and pertussis vaccine
DTP4	4 doses of diphtheria, tetanus, and pertussis vaccine
HepB2	2 doses of hepatitis B vaccine
HepB3	3 doses of hepatitis B vaccine
Hib2	2 doses of *Haemophilus influenza* type b vaccine
Hib3	3 doses of *Haemophilus influenza* type b vaccine
KDHE	Kansas Department of Health and Environment
MMR1	1 dose of measles, mumps, and rubella vaccine
MOGE	Moved out of the area or going elsewhere for health care
NIS	National Immunization Survey
Polio2	2 doses of polio vaccine
Polio3	3 doses of polio vaccine
PNU1	1 dose of pneumococcal vaccine
PHS	Public Health Services
VAR1	1 dose of varicella vaccine

CASA 2003 EXCUTIVE SUMMARY

To determine whether Kansas reached the 90% coverage goals set by the Centers for Disease Control and Prevention (CDC) and the National Childhood Immunization Initiative (CII) immunization coverage rates of children two-years of age in 2003 were assessed at all 105 local health departments. Coverage rates in the two-year old cohort for 4 doses of diphtheria, tetanus, and pertussis (DTP4), 3 doses of polio (Polio3), 1 dose of measles, mumps, and rubella (MMR1), 3 doses of *H. influenzae* (Hib3), 3 doses of hepatitis B (HepB3), and 1 dose of varicella (VAR1) were measured. The combination of DTP4, Polio3, MMR1, Hib3, and HepB3 (4-3-1-3-3) was analyzed as well. In order to identify non-immunized children sooner, one-year old children were also included in this assessment. Evaluation of coverage rates for the one-year old children in 2003 included the following: 3 doses of diphtheria, tetanus, and pertussis (DTP3), 2 doses of polio (Polio2), 2 doses of *H. influenzae* (Hib2), 2 doses of hepatitis B (HepB2), individually and the combination of DTP3, Polio2, Hib2, and HepB2 (3-2-2-2). Coverage rates of the pneumococcal vaccine (PNU) were examined for the first time in 2003 for the one-year old cohort.

In the two-year old cohort, the number of local health departments achieving the 90% coverage goal was similar to the number of counties in 2002. However, the number of counties with at least 90% coverage for DTP4 and 4-3-1-3-3 continues to decline. The county mean immunization coverage rates remained the same as last year for all single antigens except DTP4 and the 4-3-1-3-3 combination. Since 2000, mean coverage rates for the 4-3-1-3-3 have declined by more than 16 percentage points over these four years. This is a reflection of the declining DTP4 mean coverage rates which have also declined each year since 2000. However, in March 2001, CDC recommended that vaccine providers defer the fourth dose of DTP.[1] Despite the decline of DTP4 and 4-3-1-3-3 coverage rates, mean coverage rates for Polio3, MMR1, Hib3 and HepB3 remained above the 90% coverage goal.

Counties were categorized by population density and coverage rates were compared among these groups. Mean coverage rate estimates were lowest among the "moderately populated" group for all vaccines and 4-3-1-3-3 when compared to the other two groupings.

For the one-year old cohort in 2003, the statewide mean coverage rates were similar to the rates from 2002. For Polio2, Hib2, and HepB2, mean coverage rates were once again better than 90%. In 2003, mean immunization rates for the pneumococcal conjugate vaccine were also examined. The pneumococcal conjugate vaccine was licensed for use in February 2000. The mean coverage rate for one dose of PNU was 77% and the mean coverage rate for PNU3 was 45%.

Children who started their immunization series on time were 136% in the one-year old cohort and 80% in the two-year old cohort more likely to complete the series than those who started late. At two-years of age, 30% of the children needed only one immunization to be up-to-date. For these children requiring just one immunization, 97% were missing DTP4.

[1] Update on the supply of Tetanus and Diphtheria Toxoids and of Diphtheria and tetanus Toxoids and Acellular Pertussis Vaccine. MMWR 2001;50:189-190

BACKGROUND

Immunization of children against nine diseases has proven effective in reducing the morbidity and mortality of those diseases. For this reason, the Centers for Disease Control and Prevention (CDC) and the National Childhood Immunization Initiative (CII) have set goals of 90% immunization coverage for all children by their second birthday. The following single antigens and a combination of all vaccines are included: 4 doses of diphtheria, pertussis, and tetanus vaccine (DTP4); three doses of polio vaccine (Polio3); one dose of measles, mumps, and rubella vaccine (MMR1); three doses of *Haemophilus influenzae* type b vaccine (Hib3); three doses of hepatitis B vaccine (HepB3); and 1 dose of varicella (VAR1). The combination of DTP4, Polio3, MMR1, Hib3, and HepB3 is referred to as the 4-3-1-3-3 combination.

Even though no immunization coverage goals for one-year old children have been established, according to the recommended schedule children are recommended to receive the following immunizations by their first birthday: 3 doses of diphtheria, pertussis, and tetanus vaccine (DTP3); two doses of polio vaccine (Polio2); two doses of *Haemophilus influenzae* type b vaccine (Hib2); two doses of hepatitis B vaccine (HepB2) and pneumococcal vaccine (PNU). The complete set DTP3, Polio2, Hib2, and HepB2 is referred to as the 3-2-2-2 combination. One-year old children were included in this assessment in order to estimate the magnitude of non-immunized and under immunized children with the objective of having these children receive all immunizations by their second birthday.

The field staff at the Immunization Program from Kansas Department of Health and Environment assessed immunization levels of both two-year old and one-year old children at all local health departments. The assessments included in this study were conducted between January 1, and December 31, 2003.

METHODS

Using the Clinic Assessment Software Application (CASA) designed by the CDC, immunization coverage rates were evaluated at all local health departments for children either one-year old or two-years old. The one-year old cohort included all children between 12 through 23 months old and the two-year old cohort included all children 24 through 35 months old based on the date of assessment. Children were excluded if they were documented as having moved out of the area or gone elsewhere for health care (MOGE). For local health departments with 100 or fewer eligible records all records were examined. There were two methods used for local health departments with a larger number of records: 1.) a listing of eligible children was generated and then a random sample of at least 100 records was chosen and examined or 2.) all records were examined if the local health department had the capabilities.

At the local health departments, coverage rates for DTP4, Polio3, MMR1, Hib3, HepB3, VAR1 and the 4-3-1-3-3 combination were examined for the two-year old cohort. For the one-year-old cohort, coverage rates for DTP3, Polio2, Hib2, HepB2, PNU and the 3-2-2-2 combination were evaluated. Results and explanations of the immunization assessment were given to each local health department. The local health departments were also provided with a list of all children from the sample that were not up-to-date for immunizations or were considered as a missed opportunity in order to help the health departments identify the children who still needed at least

one vaccine. A child is considered as a missed opportunity if he/she visits the health department for any reason and does not receive all of the eligible immunizations.

Following an assessment at the local health department, immunization field staff discussed potential areas for improvement in management of the immunization clinic. Procedural changes such as changes in personnel, practices, record keeping, tracking patients, and reminder/recall system were evaluated in order to better assess the changes on coverage rates. Factors that affect changes on coverage rates include implementation of computerized tracking system, new recall/reminder system, method of classifying children who had moved or gone elsewhere (MOGE), and change of in immunization delivery practices. CASA was used as a quality improvement tool, with each health department received an overall review of their immunization coverage rates with suggestions for practice change to increase coverage rates.

Additional analysis using SAS 8.2 was performed on the aggregate data from all health departments. The percentage of local health departments achieving the 90% immunization coverage goal was examined for the two-year-old cohort. These results were compared to immunization rates for 2002 in order to determine increases or decreases in coverage rates over time.

Data from all health departments were combined and analyzed for mean, median, and range for single vaccines and combinations. Also the percent of children up-to-date for immunization at interim months of age were computed for each cohort.[2] For both cohorts, the interim months of age used were 3, 5, 7, 9 and 12 and the additional months of 16, 19, 21 and 24 were examined for the two-year old cohort.[3] The interim points of 3 and 24 months of age were used to assess the number of children that started their immunization series either on time or late and the number that finished on time or late for the two-year old cohort. Children who had received all necessary immunizations by the appropriate age were defined as on time and those who were missing at least one immunization recommended for that age were defined as late. The children late at 24 months were further examined to determine how many more immunizations they needed in order to be up-to-date. For the one-year old cohort, the interim points 3 and 12 months were used instead.

Also, counties were grouped together based on their population density. Mean immunization coverage rates were estimated and compared among these groups. These rates have limitations as previously indicated for the statewide rates. Population densities in the 2001 Annual Summary of Vital Statistics were combined to create 3 groups (Appendix 1)[4]. Counties that

[2]Statewide rates of immunization coverage were calculated by combining all children in the samples obtained from all counties. Each county's sample is obtained independently from all other counties' samples, and each sample represents a proportion of children which is different from county to county. Statewide rates calculated in this way may be inaccurate, and may not represent the rate that would be found if one probability sample was selected for the whole state, or if each county sample received an appropriate weight during the analysis. The only purpose of the calculation presented in this document is to allow comparisons at different ages, not to make inference on the true statewide rate for any age groups.

[3]Appropriate immunizations were based on the 2003 ACIP recommendations. MMWR 2003; 52 (04):Q1-Q4..

[4] http://www.kdhe.state.ks.us/hci/as01/as2001.html

were originally classified as Frontier or Rural, were now classified as "sparsely populated". Counties that were originally classified as Densely-Settled, Rural and Semi-Urban, were now classified as "moderately populated". And counties that were classified as Urban, remained the same.

RESULTS

TWO-YEAR OLD COHORT

For the two-year old cohort, 8190 records were reviewed with a range of 5 to 514 records from 105 individual counties. The mean number of records examined for the two-year old cohort was 78 with a median of 47 records per county. Records were also grouped and examined for each of the population density groups: 2686 records (33% of all records) for "sparsely populated" counties, 4211 records (51% of all records) for "moderately populated" and 1293 records (16% of all records) for the "urban" counties.

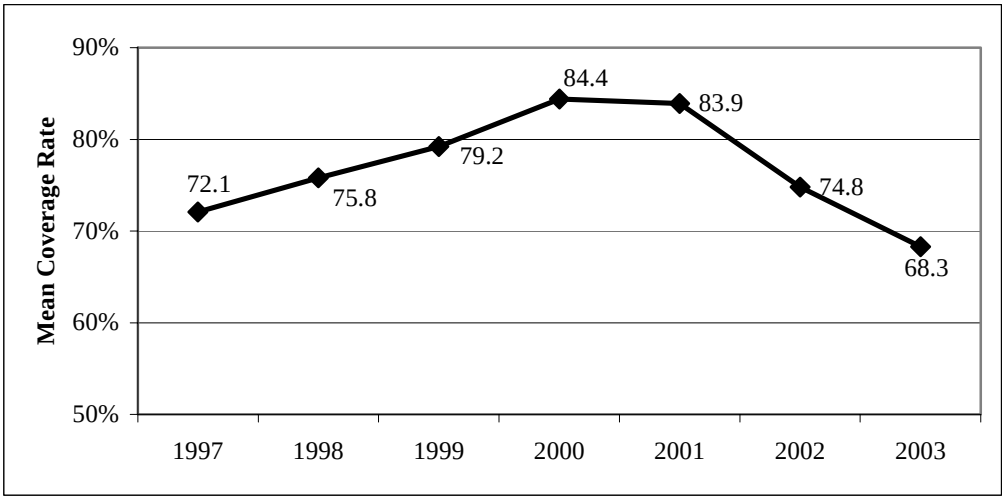
Statewide Mean, Median, and Range of Immunization Rates for Single and Combination of Vaccines

In the two-year old cohort, the statewide mean coverage rates for all single vaccines except for DTP4 have remained the same compared to the 2002 CASA. The mean coverage rates exceeded the coverage goal of 90% for Polio3, MMR1, Hib3, and HepB3 (Table 1). The mean coverage rates for DTP4 and 4-3-1-3-3 have decreased for the second year in a row (Figure 1). The median was also similar to the median values of the 2002 CASA for Polio3, MMR1, Hib3, HepB3, and VAR1. Despite coverage rates remaining similar to those in 2002, an increase of variability among local health departments was seen in the widening of the range of immunization coverage rates.

Table 1: Immunization Coverage Rate Mean, Median, and Range for the Two-Year Old Cohort at County Health Departments for the 2002 and 2003 CASA.

	2002			2003		
Vaccine	**Mean (%)**	**Median (%)**	**Range (%)**	**Mean (%)**	**Median (%)**	**Range (%)**
DTP4	76.2	80.0	23.1-100	69.5	74.3	9.3-100
Polio3	96.1	97.4	62.1-100	93.3	95.0	58.4-100
MMR1	94.1	94.7	58.0-100	93.5	95.1	49.3-100
Hib3	94.2	95.4	66.5-100	93.7	95.8	55.8-100
HepB3	93.4	95.0	59.4-100	93.6	95.2	59.4-100
4-3-1-3-3	74.8	77.4	23.1-100	68.3	71.4	23.1-100
VAR1	64.1	70.0	4.5-96.8	65.6	70.0	4.5-96.8

Figure 1: Mean Immunization Coverage Rates in the Two-Year Old Cohort for the 4-3-1-3-3 combination at County Health Departments in Kansas.



Mean Immunization Rates at Interim Time Points

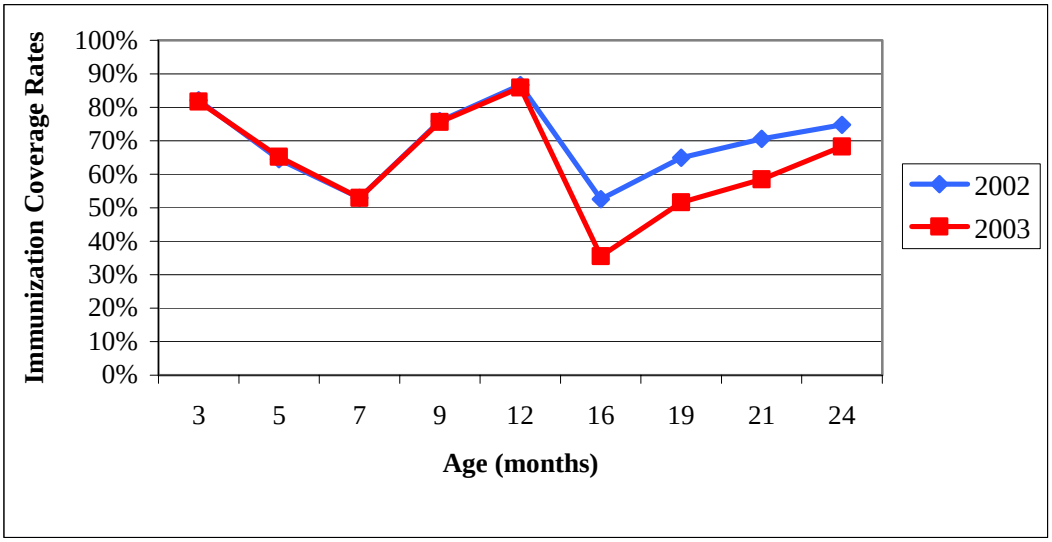
Mean immunization coverage rates were examined at interim month time points. The immunizations needed at each time interval are listed in Table2. At 3 months of age, the mean immunization coverage rate was 81.7% (Figure 2). Immunization coverage rates decreased by almost 30 percentage points by 7 months of age. Then at 12 month of age, immunization coverage rates recovered to 86%. At 16 months of age, immunization coverage rates had decreased to only 35.5%. This decrease is a reflection of the DTP4 deferral since coverage rates for all other vaccines were at least 78%.

Table 2: Recommended Vaccines at Selected Time Points and Combined Immunization Coverage Rates (%) for Two-Year Old Cohort in Kansas, 2002-2003 CASA.*

AGE	VACCINE	2002	2003
3 months	**DTP1, Polio1, Hib1, HepB1**	82.1	81.7
5 months	**DTP2, Polio2, Hib2, HepB2**	64.5	65.3
7 months	**DTP3**, Polio2, Hib2, HepB2	53.0	52.9
9 months	DTP3, Polio2, Hib2, HepB2	75.9	75.6
12 months	DTP3, Polio2, Hib2, HepB2	86.7	85.9
16 months	**DTP4, Polio3, Hib3, HepB3, MMR1**	52.6	35.5
19 months	DTP4, Polio3, Hib3, HepB3, MMR1	65.0	51.6
21 months	DTP4, Polio3, Hib3, HepB3, MMR1	70.6	58.6
24 months	DTP4, Polio3, Hib3, HepB3, MMR1	74.8	68.3

*Vaccines in bold type denote new vaccine for that time interval.

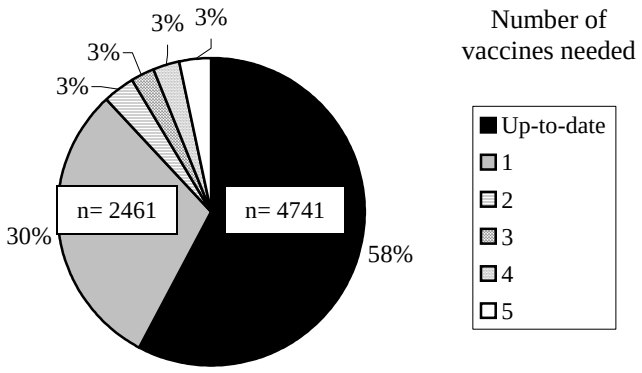
Figure 2: Immunization Coverage Rates for Two-Year Old Cohort in Kansas at Selected Time Points, 2002-2003 CASA.



Children's up-to-date status at 3 months of age was compared to their up-to-date status at 24 months of age. At three months of age, 6646 children were up-to-date for DTP1, Polio1, Hib1, and HepB1. Of those children who started on time at 3 months, 63% (4196 children) had completed all necessary immunizations (DTP4, Polio3, Hib3, HepB3, and MMR1) on time by 24 months of age. However, only 35% (545) of the children who were late at 3 months of age completed all immunizations by 24 months of age. This means that children who start on time are 80% (relative risk ratio 1.8) more likely complete the series on time by 24 months of age compared to those children who do not begin the series on time.

At 24 months of age, 3449 (42%) of all two-year olds were behind schedule. Of those children, 2461 needed only one more immunization in order to be up-to-date. And of those children needing just one immunization, 96% (2375) needed DTP4 in order to be up-to-date at 24 months of age (Figure 3).

Figure 3: Number of Immunizations Needed in Order to Be Up-to-date at 24 Months of



Age in Two-Year Old Cohort in Kansas, 2003 CASA.

*Children needing 2-5 vaccines to be up-to-date represent <300 children for each.

Peer Groups

Counties were grouped together based on their population density. Mean immunization coverage rates were compared among these groups (Table 3). Compared to the mean coverage rate estimates of the other two groups, the mean coverage rate estimates for the "moderately populated" counties was lower for all vaccines and for the 4-3-1-3-3 combination. This trend was the same trend seen in the 2002 CASA. "Sparsely populated" counties maintained the same coverage rates for DTP4 however; large decreases were seen in the other two groups (Table 4).

Table 3: Mean Immunization Coverage Estimates (%) Among Counties in Kansas Based on Population Density for Two-Year Old Cohort, 2003 CASA.

	Counties by Population Density - Collapsed Groups		
Vaccine	**Sparsely Populated (n=69)**	**Moderately Populated (n=31)**	**Urban (n=5)**
DTP4	76.5	54.3	67.5
Polio3	95.1	89.4	93.3
MMR1	95.2	89.9	92.1
Hib3	95.7	89.7	91.4
HepB3	94.9	90.9	92.2
4-3-1-3-3	75.2	53.4	65.7
VAR1	68.6	58.2	71.1

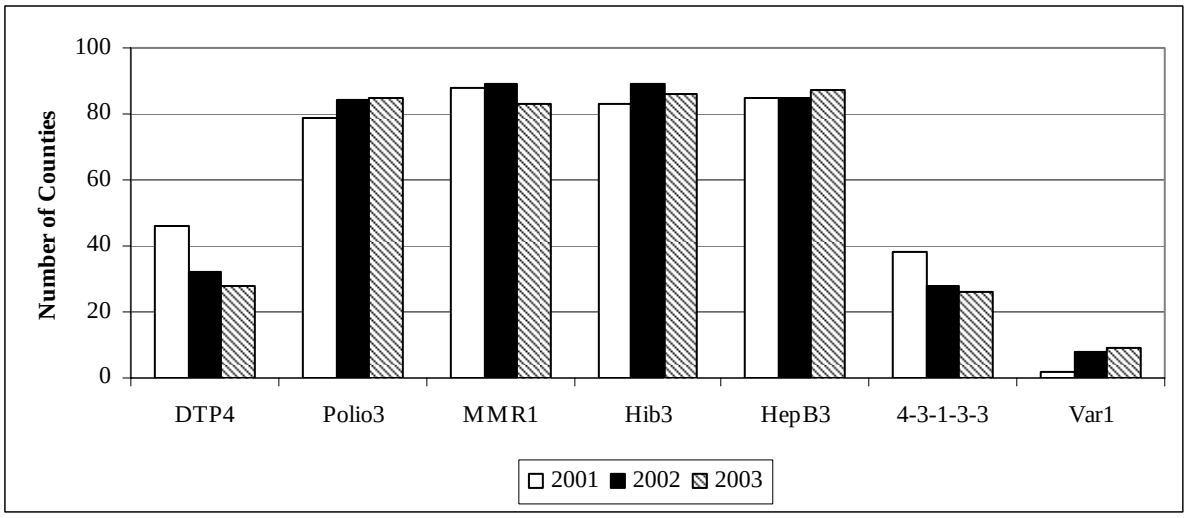
Table 4: Mean Immunization Coverage Estimates Among Counties in Kansas Based on Population Density for DTP4 in Two-Year Old Cohort, 2002-2003 CASA

	2002	2003
Sparsely Populated (n=69)	78.5	76.5
Moderatley Populated (n=31)	71.3	54.3
Urban (n=5)	80.0	67.5

Counties achieving the 90% Goal

The immunization coverage rate goal is 90% or better for single vaccines and for the combination of vaccines. The number of local health departments in 2003 achieving 90% or better coverage increased slightly for Polio3, HepB3 and Var1 compared to 2002 (Figure 4). The number of local health departments achieving 90% for DTP4 has decreased from 46 in 2002 to 28 local health departments in 2003.

Figure 4: Number of County Health Departments in Kansas Achieving at Least 90% Immunization Coverage for Single Vaccines in the Two-Year Old Cohort for 2001-2003 CASA.



ONE-YEAR OLD COHORT

For the one-year old cohort, 9568 records were reviewed with a range of 1 to 1079 records from 105 individual counties[5]. In the one-year old cohort, a mean of 91 records and a median of 49 records per county were reviewed. Records were also grouped and examined for each of the population density groups: 2784 records (29% of all records) for "sparsely populated" counties,

[5] Osage county had only 1 record for the one-year old cohort and as a result of this small number was removed from analysis.

4392 records (46% of all records) for "moderately populated" and 2391 records (25% of all records) for the "urban" counties.

Mean, Median, and Range of Statewide Immunization Rates for Single Vaccines and Combination of Vaccines

Mean coverage rates for Polio2, Hib2, and HepB2 exceeded 90% coverage (Table 5). Compared to the one-year old cohort in 2002, the mean immunization coverage rates remained the same. In February 2000, a new pneumococcal vaccine was licensed for all children less than 2 years of age and children aged 2-5 years who are at increased risk for pneumococcal disease. Mean immunization coverage rates were examined for Pnu1, Pnu2, and Pnu3 which are scheduled to be administered at 2, 4, and 6 months of age, respectively (Table 6).

Table 5: Immunization Coverage Mean, Median, and Range for One-Year Old Cohort at County Health Departments in Kansas for the 2002-20003 CASA.*

	2002			2003		
Vaccine	**Mean (%)**	**Median (%)**	**Range (%)**	**Mean (%)**	**Median (%)**	**Range (%)**
DTP3	83.3	86.0	50-100	82.9	85.8	27.8-100
Polio2	92.5	95.2	50-100	92.5	95.3	55.6-100
Hib2	92.4	95.2	50-100	92.3	94.7	52.8-100
HepB2	93.1	95.4	50-100	92.8	95.7	55.6-100
3-2-2-2	82.0	85.0	48.8-100	81.4	84.9	27.8-100

* Osage County had only 1 child in the one-year old age group so and this child was not up-to-date at one year and so the county was not included in analysis.

Table 6: Immunization Coverage Mean, Median, and Range for Pneumococcal Vaccine in the One-Year Old Cohort for 2003 CASA.

Vaccine	**Mean (%)**	**Median (%)**	**Range (%)**
Pnu1	76.8	85.9	13.3-100
Pnu2	66.2	71.4	5.6-100
Pnu3	44.5	45.7	6.7-89.5

Mean Immunization Coverage Rates at Interim Time Points

Like the two-year old cohort, the one-year old cohort immunization levels were assessed at interim months. At 3 months of age, 80% of the children were fully immunization for DTP1, Polio1, Hib1, and HepB1 (Table 7). However, the mean coverage rates dropped by more than 30 percentage points by 7 months of age where less than half of the children were fully immunized. Fortunately by 12 months of age, the mean immunization coverage rates returned to the same levels as at 3 months of age.

Table 7: Recommended Vaccines at Selected Time Points and Combined Immunization Coverage Rates (%) for One-Year Old Cohort in Kansas, 2002-2003 CASA.*

AGE	ANTIGEN	2002	2003
3 months	**DTP1, Polio1, Hib1, HepB1**	80.4	79.9
5 months	**DTP2, Polio2, Hib2, HepB2**	61.5	60.2
7 months	**DTP3**, Polio2, Hib2, HepB2	49.2	45.5
9 months	DTP3, Polio2, Hib2, HepB2	71.6	71.0
12 months	DTP3, Polio2, Hib2, HepB2	82.0	81.4

*Vaccines in bold type denote new vaccine for that time interval.

The likelihood of being up-to-date for the 3-2-2-2 combination by 12 months of age depending on the up-to-date status at 3 months of age was also examined. At 3 months of age, 7448 children were up-to-date for DTP1, Polio1, Hib1, and HepB1. Of those children up-to-date at 3 months of age, 69% (6571 children) were up-to-date at 12 months of age for DTP3, Polio2, Hib2, and HepB2. However, only 37% (793) of those children behind schedule were up-to-date at 12 months of age. This means that children who are on time at 3 months of age are 136% (relative risk ratio 2.36) more likely to be up-to-date at 12 months of age compared to those children who do not begin the series on time.

Peer Groups

The counties in the "sparsely populated" group had the highest coverage rate estimates for the 3-2-2-2 combination and all single vaccines compared to the "moderately populated" and "urban" groups of counties (Table 8). This trend and results were similar to those seen in 2002 CASA. However, the disparities among the counties are less than in 2002 CASA. For example the 3-2-2-2 combination in 2002 CASA ranged from 70.8% to 84.9% and in 2003 CASA the range is only 78.1% to 83.5%.

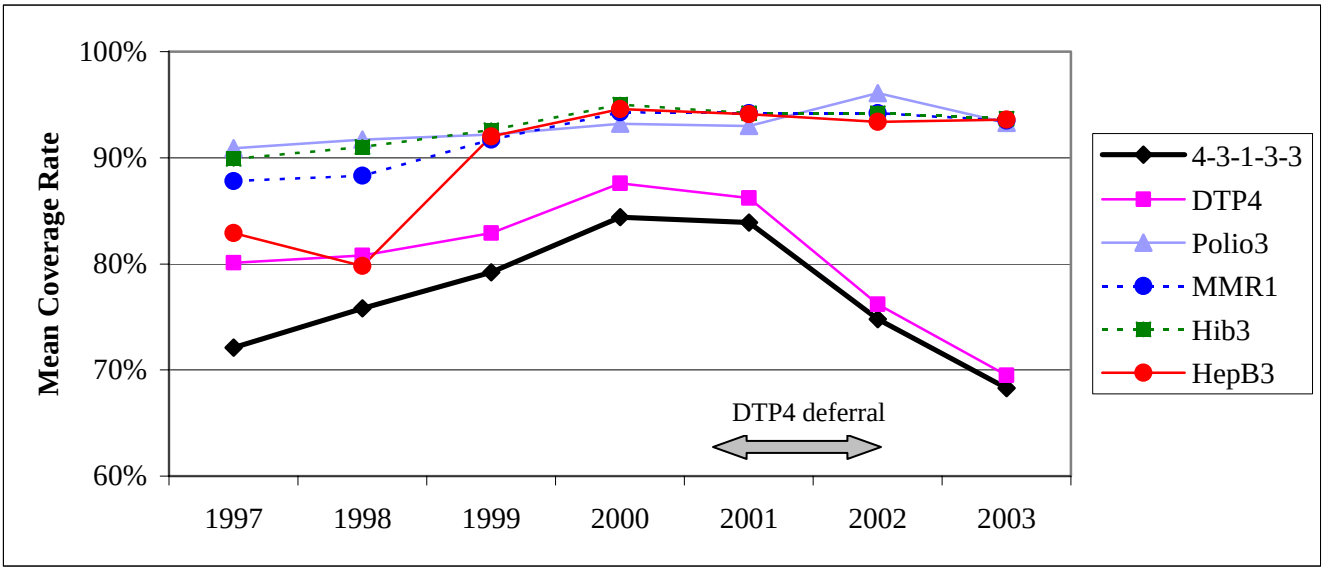
Table 8: Mean Immunization Coverage Rate Estimates (%) Among Counties based on Population Density for the One-Year Old Cohort in Kansas, 2003 CASA.

Vaccine	Sparsely Populated (n=69)	Moderately Populated (n=30)	Urban (n=5)
DTP3	85.0	78.2	80.7
Polio2	93.9	89.6	89.3
Hib2	93.6	89.9	89.0
HepB2	93.8	90.8	89.8
3-2-2-2	83.5	76.4	78.1

DISCUSSION

In the two-year old cohort, the numbers of local health departments achieving the 90% coverage goal were similar to the number of counties in 2002. However, the number of counties with at least 90% coverage for DTP4 and 4-3-1-3-3 continues to decline. Mean immunization coverage rates remained the same this year again for all singe antigens except DTP4 and the 4-3-1-3-3 combination. Since 2001, mean coverage rates for the 4-3-1-3-3 have declined by more than 16 percentage points. This is a reflection of the declining DTP4 mean coverage rates which have also declined each year since 2001 (Figure 5).

Figure 5: Mean Immunization Coverage Rates in the Two-Year Old Cohort at County Health Departments in Kansas, 1997-2003.



Several reasons may have contributed to the decline of DTP4 coverage rates. One reason may be related to the deferral of the fourth dose of DTP4. In March 2001, CDC recommended vaccine providers defer the fourth dose of DTP and prioritize vaccine administration for the primary series and the fifth dose. The fourth DTP dose deferral lasted until July 2002. The DTP supply issues were disproportionately experienced by the public sector and by those private providers who depended on supply from the public sector. For this reason, the impact varies among state and county immunization programs.[6]

The effect of this deferral is visible among children not up-to-date at 24 months. Of those children needing just one immunization, 96% (2375) needed DTP4 in order to be up-to-date at 24 months of age. On the other hand, the mean immunization coverage rates for DTP3 have not been affected over the past three years. Mean immunization coverage rates have remained greater than 95% and at least 95 counties have rates equal to or greater than 90%.

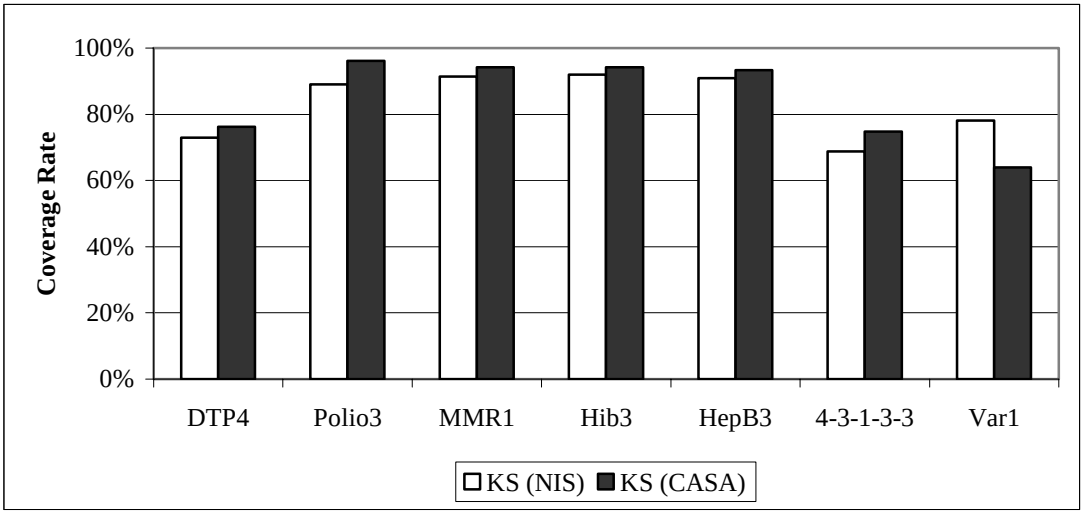
[6] Impact of Vaccine Shortage on Diphtheria and Tetanus Toxoids and Acellular Pertussis vaccine Coverage Rates Among Children Aged 24 Months – Puerto Rice, 2002. MMWR 2002:51:6676-668.

Another reason that might have contributed to the decline of DTP4 coverage rates is the decline of coverage rates at 7 months of age where rates dropped to 53%. The only added immunization at this age was DTP3. Children who receive DTP3 late may not be able to receive DTP4 on subsequent visits since the minimum interval between the two doses is 6 months.

In both age cohorts, mean coverage rate estimates were greatest for those counties who were "sparsely populated" compared to the other two county groupings of population density, with the exception of VAR1. The mean coverage rate estimates were similar to the estimates in 2002 CASA with the exception of DTP4. Mean coverage rate estimates were similar among the groups except for DTP4 and VAR1. For VAR1, "urban" and "sparsely populated" had similar rate estimates but both with at least 10 percentage points greater than "moderately populated". And for DTP4, the "sparsely populated" had estimates similar to 2002 CASA. On the other hand, estimates of DTP4 dropped by 17 and 12.5 percentage points for "moderately populated" and "urban", respectively.

The two-year old cohort results for 2003 CASA were compared to the National Immunization Survey (NIS) data results for July 2002 to June 2003, which refers to a similar time period and in the survey.[7] The NIS is a population-based sample based on a smaller sample size representing a larger population of children. Despite the 2003 CASA not being a population based survey, coverage rate results are overall similar to the 2003 NIS data for Kansas for all antigens except Polio3, Var1, and 4-3-1-3-3 (Figure 6).

Figure 6: Comparison of Immunization Coverage Rates in the Two-Year Old Cohort Between 2003 NIS for Kansas and 2003 CASA.



[7] Data for NIS was collected by the Centers for Disease Control and Prevention (CDC) through a telephone survey of randomly selected household. For accuracy, the healthcare providers (family physician, pediatricians, etc.) of the children included in the survey were contacted by mail. NIS estimates were calculated using both household and provider data.

This study had several limitations. The first was that this was not a population-based study. This study only included children who attended a local health department for at least one of their immunizations and did not include children who attended for any reason, which might have resulted in an overestimation of coverage rates. On the other hand, an underestimation of coverage rates was also possible if immunization records fail to identify children who have moved or gone elsewhere (MOGE) for immunizations.

Despite the limitations, this survey served as an effective tool for assessing immunization coverage rates both at the state level and at the county level. When assessing coverage rates at the county level, the CASA was a useful tool in swiftly identifying problem areas and under immunized children. For these reasons, this assessment will continue to be used to track immunization coverage rates in Kansas.

APPENDIX 1: Kansas counties grouped together based on population density.

SPARSELY POPULATED		MODERATELY POPULATED	URBAN
Anderson	Mitchell	Allen	Douglas
Barber	Morris	Atchison	Johnson
Brown	Morton	Barton	Leavenworth
Chase	Nemaha	Bourbon	Sedgwick
Chautauqua	Ness	Butler	Shawnee
Cheyenne	Norton	Cherokee	Wyandotte
Clark	Osborne	Cowley	
Clay	Ottawa	Crawford	
Cloud	Pawnee	Dickinson	
Coffey	Phillips	Ellis	
Comanche	Pratt	Finney	
Decatur	Rawlins	Ford	
Doniphan	Republic	Franklin	
Edwards	Rice	Geary	
Elk	Rooks	Harvey	
Ellsworth	Rush	Jefferson	
Gove	Russell	Labette	
Graham	Scott	Lyon	
Grant	Sheridan	McPherson	
Gray	Sherman	Miami	
Greeley	Smith	Montgomery	
Greenwood	Stafford	Neosho	
Hamilton	Stanton	Osage	
Harper	Stevens	Pottawatomie	
Haskell	Thomas	Reno	
Hodgeman	Trego	Riley	
Jackson	Wabaunsee	Saline	
Jewell	Wallace	Seward	
Kearny	Washington	Sumner	
Kingman	Wichita		
Kiowa	Wilson		
Lane	Woodson		
Lincoln			
Linn			
Logan			
Marion			
Marshall			
Meade			